

## Materials for the Lomariopsidaceae of Taiwan

Chen-Meng Kuo

Department of Botany, National Taiwan University, Taipei, Taiwan, Republic of China

(Received March 3, 1990; Accepted May 2, 1990)

**Abstract.** Altogether fifteen taxa of three genera (*Bolbitis*, *Elaphoglossum* and *Lomariopsis*), including a new hybrid, are enumerated as a result of a study of the Lomariopsidaceae of Taiwan, with keys to the genus and species, specimens examined, notes on habitat and some taxonomic discussions.

**Key words:** *Bolbitis*; *Elaphoglossum*; *Lomariopsis*; Lomariopsidaceae; Pteridophytes; Taiwan.

When preparing the account of the ferns for the flora of West Tropical Africa, Alston (1956) proposed a new family "taxon" Lomariopsidaceae containing three genera, *Elaphoglossum*, *Lomariopsis*, and *Bolbitis*. But on the basis of characters such as the presence of frond-dimorphism, the structure of the leaf bases, the division of the lamina, the venation, the pattern of vein-endings, the placement of the sporangia, the morphology of the spores and gametophytes, and the habitats, Pichi-Sermolli (1968) suggested to group *Elaphoglossum*, *Microstaphyla* and *Peltapteris* in the family Elaphoglossaceae which is phylogenetically related to, but distinctly separated from Lomariopsidaceae. When observing juvenile leaves of *Lomariopsis* which show great similarity to *Elaphoglossum*, Hennipman (1977) strongly advocated to merge Elaphoglossaceae with Lomariopsidaceae, and the family then consists of six genera, i. e. *Lomariopsis*, *Teratophyllum*, *Bolbitis*, *Arthrobotrya*, *Elaphoglossum*, and *Lomagamma*. Holttum (1978) recognized eight genera, i. e. *Bolbitis*, *Lomariopsis*, *Lomagamma*, *Teratophyllum*, *Thysanosoria*, *Elaphoglossum*, *Peltapteris*, and *Microstaphyla* in his excellent paper. According to Holttum's generic concept, there are three genera in Taiwan, viz. *Bolbitis*, *Elaphoglossum* and *Lomariopsis*.

Members of the Lomariopsidaceae in Taiwan are characterized by their dimorphic fronds with acrostichoid arrangement of the sporangia and the veins being free or sagenioid. A few other genera in Taiwan also

have dimorphic fronds and acrostichoid sporangia, they are: *Acrostichum*, *Cheiropleuria*, *Leptochilus*, and *Tectaria* (*Hemigramma* and *Quercifilix*), but these genera are only superficially alike and do not belong to Lomariopsidaceae.

### Key to the Genera

1. Fronds of mature plants simple and entire; plants epiphytic . . . . . 2. *Elaphoglossum*
1. Fronds of mature plants 1-pinnate; plants terrestrial, petrophilous, or scandent . . . . . 2
2. Pinnae articulate to rachis; terminal pinna without any bud . . . . . 3. *Lomariopsis*
2. Pinnae not articulate at their bases; terminal pinna bearing an adventitious bud at its apex . . . . .  
. . . . . 1. *Bolbitis*

### 1. *Bolbitis* Schott

Iwatsuki (1959) was the first to combine *Bolbitis* and *Egenolfia*. None of the characters formerly used to separate the two genera could be shown to be valid (Iwatsuki, 1959; Hennipman, 1977). Iwatsuki (1959) reported five *Bolbitis* species, *Bolbitis appendiculata*, *B. serrulata*, *B. contaminans*, *B. subcordata*, and *B. heteroclita* to be present in Taiwan, with addition of a doubtful species, *B. scalpturata*. Hennipman (1977), in his monograph, also reported the same five species from Taiwan but with two names changed, i. e.: *B. angus-*

*tipinna*, *B. appendiculata*, *B. rhizophylla*, *B. heteroclita*, and *B. subcordata*. DeVol and Kuo (1975) used *Bolbitis* and *Egenolfia* instead of *Bolbitis*; they reported a total of six taxa, viz. *B. contaminans*, *B. heteroclita*, *B. subcordata*, *E. appendiculata*, *E. laxireticulata*, and *E. rhizophylla*. Later Kuo and Wang (1985) demonstrated the existence of *B. sculpturata* with a few scattered populations in southwestern Taiwan, and Kuo and Yu (1986) in a mimeographed paper, reported the finding of two natural hybrids, *B. × laxireticulata* and *B. × nanjenensis* in the Ken-ting National Park of Taiwan.

*Bolbitis* is a pantropical genus. It is generally distributed between the Tropic of Cancer and the Tropic of Capricorn, also here and there beyond. *Bolbitis* species of Taiwan grow usually below 1000 m altitude and are associated with broad-leaved forests in mountain ravines.

### Key to Species and Hybrids

1. Width of mature fronds less than 12 cm . . . . . 2
  1. Width of mature fronds more than 15 cm . . . . . 5
  2. Veins anastomosing or partially anastomosing . . . . . 3
  2. Veins free . . . . . 4
  3. Pinnae entire or rarely slightly denticulate at their apices; veins anastomosing . . . . . 5. *B. × nanjenensis*
  3. Pinnae crenately lobed, slightly denticulate in the lobes; veins in most cases free, only a few veins anastomosing . . . . . 4. *B. × laxireticulata*
  4. Adventitious buds present at the apices of the fronds; bases of pinnae more or less symmetrical . . . . . 6. *B. rhizophylla*
  4. Adventitious buds far below the tips of the fronds; bases of pinnae rather asymmetrical . . . . . 2. *B. appendiculata*
  5. Terminal pinna with pinnatifid base . . . . . 6
  5. Terminal pinna without pinnatifid base . . . . . 7
  6. Costal areolae without an excurrent free vein on their arch; pinnae linear, less than 2 cm wide, gradually narrowed towards apex . . . . . 1. *B. angustipinna*
  6. Costal areolae bearing an excurrent free vein on their arch; pinnae broadly oblong, caudate, ca. 2.5 cm wide . . . . . 8. *B. subcordata*
  7. Lateral pinnae 3.5-4.5 cm wide, usually less than 5 to a side; terminal pinna usually elongate and proliferous . . . . . 3. *B. heteroclita*
  7. Lateral pinnae less than 3 cm wide, usually more than 6 to a side; terminal pinna not elongate . . . . . 8
8. Pinnae broadly oblong, ca. 2.5 cm wide; costae purplish when dry . . . . . 7. *B. sculpturata*
8. Pinnae linear-oblong, ca. 2 cm wide; costa stramineous when dry . . . . . 1. *B. angustipinna*
1. ***Bolbitis angustipinna*** (Hayata) Nakai ex H. Ito, Journ. Jap. Bot. 14: 443. 1938; Fil. Jap. Ill. 325. 1944; Hennisman, A monograph of the fern genus *Bolbitis* 152, fig. 40: a-f. 1977; F1. Malesiana II, 1: 321. 1978.
- Leptochilus angustipinna* Hayata, Ic. Pl. Formos. 5: 297, f. 119. 1915; T. Ito, Zoku Taiwan Shokubutsu Zusetsu 32. 1928; Masamune, Short Fl. Form. 18. 1936. Type from Taiwan, *Owatari s. n.* Jan. 1898 (lectotype, see *Hennisman 1977*, TI); *Mori 2338* (TI); *Hayata & Sasaki s. n.* Jan. 1912 (TI).
- Leptochilus cuspidatus* (Presl) C. Chr. var. *crenatus* Rosenst. Hedwigia 56: 348. 1915. Type from Taiwan, based on *Faurie 281* (B; P, 3 sheets).
- Bolbitis contaminans* (Clarke) Ching in C. Chr. Ind. Fil. Suppl. 3: 47. 1934; K. Iwatsuki, Act. Phytotax. Geobot. 18: 53, fig. 9. 1959; DeVol & Kuo, Flora Taiwan 1: 348. 1975; Shieh, J. Sci. Eng. 13: 27. 1976.
- Gymnopteris contaminans* sensu Hayata, Bot. Mag. Tokyo 23: 26. 1909.
- Representative Specimens Examined*
- Taichung: Ta-shue-shan, *Liu s. n.* Oct. 24, 1957 (TAI). Nantou: Mei-yuen, *Simozawa s. n.* Nov. 11, 1928 (TAI); Chi-tou, *Kuo 14978* (TAI); *14978A\** (TAI); *10306* (TAI); *Kuoh 3602* (TAI); Ching-suei-kou, *Huang, Kuo & Kao 791* (TAI); *250* (TAI); *Huang, Kuo & Liu 750* (NTUF); Ta-huen-ping-shan, *Kuo 92* (TAI). Chiayi: Chia-sien-pao, *Matuda s. n.* Sept. 1, 1910 (TAI). Tainan: Kuan-tzu-lin, *Shimada s. n.* March 18, 1918 (TAIF). Kaohsiung: San-ping, *Sheu 500* (TAI); *Chen 3230* (TAI); *Kuo 1907* (TAI); Wai-ying-shan, *Wang 4229* (TAI); Chi-shan, *Suzuki 20878* (TAI); *Sasaki s. n.* March 8, 1936\* (TAI); Teng-chi, *Suzuki 20878* (TAI). Pingtung: Wan-chin, *Faurie 281* (B; P, 3sh.)
- Bolbitis angustipinna* is usually associated with warm-temperate broad-leaved forests at elevations between 800 m and 1300 m throughout the island and is also the sole *Bolbitis* species in Taiwan distributed at higher altitudes. This plant is less common than *B. subcordata* of lower elevations. Fronds of mature plants of

*B. angustipinna* are said to have a pinnatifid apex, but in those of juvenile plants a conform terminal pinna is usually present (specimens cited above marked by an asterisk).

2. ***Bolbitis appendiculata*** (Willd.) K. Iwatsuki, Act. Phytotax. Geobot. 18: 48. 1959; Hennipman, A monograph of the fern genus *Bolbitis* 185, figs. 49–51. 1977; Fl. Malesiana II, 1: 322. 1978.

*Acrostichum appendiculatum* Willd. Sp. Pl. 5: 114. 1810; Henry, Trans. As. Soc. Jap. 24, Suppl.: 116. 1896. Type from India.

*Polybotrya appendiculata* (Willd.) J. Smith, Journ. Bot. 4: 150. 1841; Matsum. & Hay. Enum. Pl. Formos. 585. 1906; T. Ito, Zoku Taiwan Shokubutsu Zuzetsu 38, 39. 1928.

*Egenolfia appendiculata* (Willd.) J. Smith, Ferns Brit. For. 111, fig. 1866; Ching, Bull. Fan Mem. Inst. Biol. 2: 308. 1931; Nakai, Bot. Mag. Tokyo 47: 169. 1933; Masamune, Short Fl. Form. 17. 1936; DeVol & Kuo, Fl. Taiwan 1: 350, pl. 123. 1975; Shieh, J. Sci. Eng. 13: 28. 1976.

*Polybotrya marginata* Bl. Enum. Pl. Jav. 100. 1828; Hayata, Ic. Pl. Formos. 5: 306. 1915; Ogata, Ic. Fil. Jap. 2: pl. 83. 1929. Type from Java, Mt. Burangrang.

#### Representative Specimens Examined

Ilan: Wu-shih-pi, *Masamune s. n.* Apr. 26, 1938 (TAI); Hsiao-mao-shan, *Nakamura 5128* (TAI); Niu-tou, *Suzuki s. n.* Nov. 13, 1932 (TAI). Taipei: Chin-kua-shih, *Hsu & Kuoh 10002* (TAI); Ta-tung-shan, *Kuo 1424* (TAI); Ta-tau-shan, *Chiang 23718* (TAI); *Chiang & Liu 22842* (TAI); Wu-lai, *Kuo 2251* (TAI); *2972* (TAI); *Matuda s. n.* July 25, 1918 (TAIF); A-yu, *Suzuki 15501* (TAI); *15589* (TAI); *18393* (TAI); *6741B* (TAI); *Simizu 2735* (TAI); Lu-shih-tan, *Kuo 1083* (TAI); Chin-ping-shan, *Kuo 2495* (TAI); Tsai-kong-keng-shan, *Chen 999* (TAI); Nan-kang, *Kuo 453* (TAI); Fu-shan, *Suzuki 14199* (TAI); *Fuji s. n.* Nov. 2, 1914 (TAI); *Ito & Fuji s. n.* Nov. 4, 1914 (TAIF); Kan-kou, *Sasaki s. n.* Nov. 6, 1932 (TAI); Kee-lung, *Kuo & Kao 4302* (TAI); *Simozawa s. n.* Sept. 13, 1931 (TAI); Pin-lin, *Nakamura 4767* (TAI); Chue-tzu, *Faurie 650* (B); Yang-ming-shan, *Shimada s. n.* Aug. 1, 1915 (TAIF). Hsinchu: Chia-li-chien-shan, *Sasaki s. n.* Jan. 1916 (TAIF). Taichung: Tsu-yun-shan, *Simozawa s. n.* Aug. 7, 1927 (TAI); *s. n.* June 26, 1927 (TAI); Pa-sien

-shan, *Sasaki s. n.* Nov. 23, 1922 (TAIF). Nantou: Chi-tou, *Kuoh 3516* (TAI); *3683* (TAI); *3531* (TAI); *Kao 6748* (TAI); *Jeng 551* (TAI); *553* (TAI); *Liu 180* (TAI); *Kuo 559* (TAI); *375* (TAI); Lien-hua-chih, *Hibino & Suzuki s. n.* July 21, 1936 (TAI); *s. n.* July 17, 1936 (TAI); *Suzuki s. n.* July 20, 1930 (TAI); *Sasaki s. n.* Feb. 23, 1927 (TAI); *s. n.* Dec. 30, 1925 (TAI); *Feung & Kao 358* (TAI); *Seki 47* (TAI). Chiayi: Tsao-shan Village, *Wang 5789* (TAI); Feng-chi-hu, *Kuo 1636* (TAI). Kaohsiung: Chi-shan, *Sasaki s. n.* March 8, 1936 (TAI); Teng-chi, *Ohashi et al. 23489* (TAI). Pingtung: Nan-jen-shan, *Hsu & Kuoh 13133* (TAI); *Kuo & Yu 14326* (TAI); *14118* (TAI); *Sasaki s. n.* March 27, 1932 (TAI); *Yang 127* (TAI); *Tateishi et al. 18479* (TAI); Pin-lang, *Hsu & Kuoh 7981* (TAI). Taitung: Kuei-hu, *Kuo 119* (TAI); Lan-yu, *Huang & Kao 6229* (TAI); *6204* (TAI); *Jeng 1570* (TAI); Sui-pao-tai-shan, *Yamamoto & Mori s. n.* July 25, 1937 (TAI). Hualien: Muh-kua-shan, *Nakamura 4392* (TAI).

3. ***Bolbitis heteroclita*** (Presl) Ching in C. Chr. Ind. Fil. Suppl. 3: 48. 1934; Ic. Fil. Sin. 3: pl. 119. 1933; K. Iwatsuki, Act. Phytotax. Geobot. 18: 57, fig. 12. 1959; DeVol & Kuo, Fl. Taiwan 1: 348, pl. 122. 1975; Shieh, J. Sci. Eng. 13: 27. 1976; Hennipman, A monograph of the fern genus *Bolbitis* 221, fig. 60. 1977; Fl. Malesiana II, 1: 325. 1978.

*Acrostichum heteroclitum* Presl, Rel. Haenk. 1: 15, t. 2, f. 2. 1825. Type from Sorzogon and Luzon.

*Leptochilus heteroclitus* (Presl) C. Chr. Ind. Fil. 385. 1905; Masamune, Short Fl. Form. 19. 1936.

*Leptochilus cuspidatus* (Presl) C. Chr. Ind. Fil. 384. 1906; T. Ito, Zoku Taiwan Shokubutsu Zuzetsu 33, 34. 1928; Ogata, Ic. Fil. Jap. 6: pl. 278. 1935; Masamune, Short Fl. Form. 18. 1936.

*Bolbitis koidzumii* Tagawa, Act. Phytotax. Geobot. 6: 93. 1937; H. Ito, Fil. Jap. Ill. 326. 1944. Type from Iriomote, Ryukyu, based on *Koidzumi s. n.* July 1923.

*Gymnopteris repanda* sensu Yabe, Bot. Mag. Tokyo 16: 48. 1902; Matsum. & Hay. Enum. Pl. Formos. 586. 1906.

*Bolbitis interlineata* sensu H. Ito, Journ. Jap. Bot. 14: 439, fig. 2. 1938.

#### Representative Specimens Examined

Ilan: Kuei-shan Island, *Kuo 1564* (TAI); *Masamune & Suzuki s. n.* July 3, 1932 (TAI). Pingtung:

Tsu-lao-shyu-shan, *Kuo & Yu 14855* (TAI); Chia-luo-suei, *Huang 9790* (TAI); Nan-jen-shan, *Kuo 1994* (TAI); Lao-fo-shan, *Kudo & Suzuki s. n.* Dec. 31, 1928 (TAI); *Soma s. n.* Jan. 1910 (TAIF); Lu-liao-syi, *Kuo & Yu 14607* (TAI). Taitung: Lan-yu, *Huang 9406* (TAI); *Jeng 1589* (TAI); *Sata s. n.* July 1, 1933 (TAI); *s. n.* Aug. 7, 1933 (TAI); *Chang 2295A* (TAI); *Lin 882* (TAI); *695* (TAI); *s. n.* Sept. 21, 1972 (TAI); *Kuo 2181* (TAI); *2235* (TAI); *Kuoh 4959* (TAI); *Huang & Kao 6232* (TAI); *6371* (TAI); *Masamune 4136* (TAI); *Liu 85* (TAI); *Chiang 22614* (TAI); *22609* (TAI); *22453* (TAI); *Hanara s. n.* May 13, 1943 (TAI); *Soma s. n.* July 1915 (TAI); Chen-kuan-ao, *Kawakami & Kobayashi 4783* (TAI, TAIF); Suei-bao-tai, *Suzuki 19687* (TAI); Chi-peng, *Huang 8834* (TAI); An-tung, *Kao 6128* (TAI); A-lang-wei, *Tanka s. n.* Jan. 24, 1936 (TAI). Hualien: Chin-suei-shan, *Nakamura 3584* (TAI); Tai-lu-ko, *Matuda s. n.* Aug. 5, 1918 (TAIF).

4. ***Bolbitis* × *laxireticulata*** K. Iwatsuki, Act. Phytotax. Geobot. 18: 50, fig. 7 & 8. 1959, pro sp.; Hennipman, A monograph of the fern genus *Bolbitis* 307, fig. 86: i-q. 1977. Type from Ryukyu, based on *Tagawa & Iwatsuki 2918*.

*Egenolfia laxireticulata* (K. Iwatsuki) Kuo, Fl. Taiwan 1: 352. 1975.

*Representative Specimens Examined*

Taipei: Ta-tau-shan, *Moore 1051* (TAI). Nantou: Wu-chieh, *Kuo 922* (TAI). Pingtung: Wan-li-de-shan, *Kuo & Yu 14793* (TAI); *14828* (TAI).

5. ***Bolbitis* × *nanjenensis*** Kuo, hybr. nov. (Fig. 1). [= *B. appendiculata* (Willd.) K. Iwatsuki × *B. heteroclita* (Presl) Ching]. -Type: Taiwan, Pingtung, Tsu-lao-shyu-shan, *Kuo & Yu 14856* (holotype: TAI).

Rhizoma repens, ca. 4 mm crassum, dense squamatum; squamis fusco-brunneis, ovato-lanceolatis, usque ad 3 mm longis, 1 mm basi latis, apice longe acuminatis, margine subintegris; frons sterilis 30-35 cm longa, straminea, ubique parce squamata; lamina pinnata, pinnis lateralibus 11-13 utrinque, sessilibus, oblongo-lanceolatis, 5 cm longis, 1-1.2 cm latis, apice acutis, basi oblique lateque cuneatis, margine subintegris, supra glabris, subtus and costas parcellissime squamulosis, pinnis superioribus connatis, costis infra

apicem gemmiferis; venulis reticulatis, areolas costales formantibus.

The gross morphology of *Bolbitis* × *nanjenensis* is similar to that of *B. appendiculata* but larger in every respect; both have on their rachis narrow wings, but the pinnae of *B. appendiculata* are obtuse and the spines on the margin of the pinnae are rather distinct. The pinnae of *B. × nanjenensis* are subentire, with indistinct spines; although not so complex as that of *B. heteroclita*, its venation is reticulate and there are at least costal areolae. Despite the intermediate morphological characters of *B. × nanjenensis*, which are between those of *B. appendiculata* and *B. heteroclita*, very few individuals were seen at the type locality, and all fronds are sterile. Besides, only two *Bolbitis* species were observed at the type locality, viz. *B. appendiculata* and *B. heteroclita*.

*B. × nanjenensis* was growing in a ravine in semi-original dwarf forest, on the outermost mountain slope from the seaside exposed to wind. *B. heteroclita* is a predominant terrestrial fern in the dwarf forest. The plants of *B. appendiculata* are more concentrated at the bottom of the ravine, they generally grow on rocks. The habitat of *B. × nanjenensis* is exactly intermediate, it grows on the soil banks of the ravine.

6. ***Bolbitis rhizophylla*** (Kaulf.) Hennipman, Blumea 18: 148. 1970; A monograph of the fern genus *Bolbitis* 199, fig. 52: d-r, 53. 1977; Fl. Malesiana II, 1: 323. 1978; Shieh, J. Sci. Eng. 13: 28. 1976.

*Gymnogramma rhizophylla* Kaulf. Enum. Fil. 78. 1824. Type from the Philippines, Manila.

*Egenolfia rhizophylla* (Kaulf.) Fée, Gen. Fil. 48. 1850-52; DeVol & Kuo, Fl. Taiwan 1: 352. 1975.

*Egenolfia serrulata* (Fée) Fée, Gen. Fil. 48. 1852; Ching, Bull. Fan Mem. Inst. Biol. 2: 307. 1931; Nakai, Bot. Mag. Tokyo 47: 170. 1933; Masamune, Short Fl. Form. 17. 1936; Tagawa, Act. Phytotax. Geobot. 16: 175. 1956.

*Bolbitis serrulata* (Fée) K. Iwatsuki, Act. Phytotax. Geobot. 18: 49. 1959.

*Polybotrya duplicato-serrata* Hayata, Ic. Pl. Formos. 5: 305, fig. 123A. 1915; T. Ito, Zoku Taiwan Shokubutsu Zuzetsu 40. 1928; Ogata, Ic. Fil. Jap. 3: pl. 132. 1930. Type from Taiwan, *Nakahara s. n.* Jan. 1905 (TI).

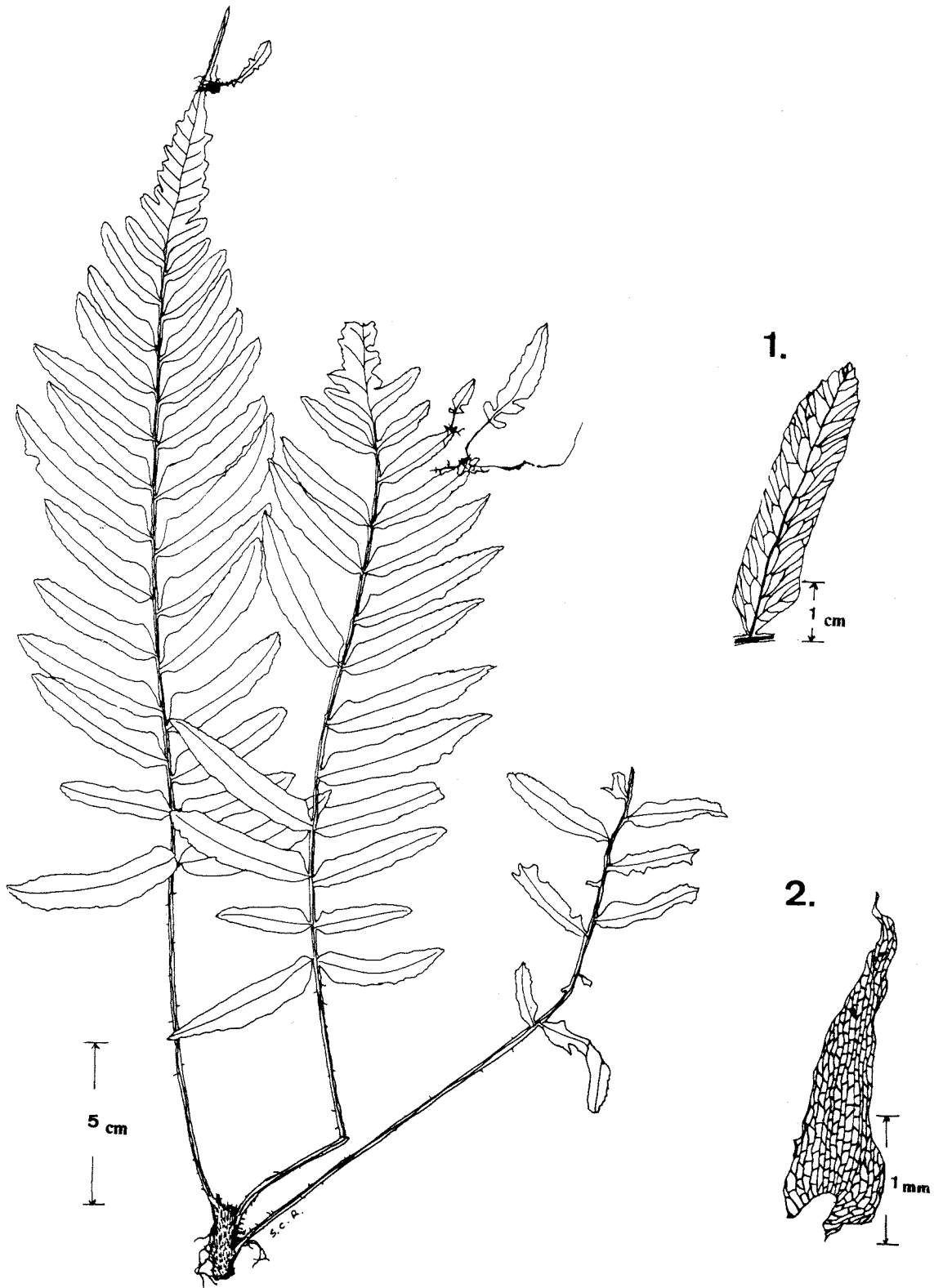


Fig. 1. *Bolbitis* × *nanjenensis* Kuo, hybrid nov. 1. One pinna showing costal areolae; 2. A scale from the stipe-base.

*Representative Specimens Examined*

Chiayi: Ta-pu, *Sasaki s. n.* Oct. 1917 (TAIF).  
Tainan: Kuan-tzu-ling, *Shimada s. n.* March 18, 1918 (TAI, TAIF). Kaohsiung: Shan-ping, *Kuo 7754* (TAI); Chi-shan, *Matuda 918* (TAI); *Mori s. n.* Nov. 11, 1907 (TAIF). Pingtung: Sha-mo, *Kuo 13852* (TAI); Wan-chin, *Faurie 279* (B); *Henry 81A* (B); *81* (K); Tsao-chou, *Nakahara s. n.* Jan. 10, 1907 (TAIF).

7. ***Bolbitis sculpturata*** (Fée) Ching in C. Chr. Ind. Fil. Suppl. 3: 50. 1934; H. Ito, Journ. Jap. Bot. 14: 439, fig. 1. 1938; K. Iwatsuki, Act. Phytotax. Geobot. 18: 59. 1959; Shieh, J. Sci. Eng. 28. 1976; Hennipman, A monograph of the fern genus *Bolbitis* 163, fig. 43: a-d. 1977; Fl. Malesiana II, 1: 321. 1978; Kuo & Wang, Yushania 2(2): 2, fig. 3. 1985.

*Heteroneuron sculpturatum* Fée, Acrost. 95, t. 56. 1845. Type from Philippines, Manila, collected by Gaudichaud (B, 2 sheets).

*Leptochilus virens* sensu Hayata, Ic. Pl. Form. 5: 301. 1915.

*Representative Specimens Examined*

Chiayi: Tsen-wen-suei-ku, *Wang 3197* (TAI); *2753* (TAI); *3166* (TAI).

8. ***Bolbitis subcordata*** (Copel.) Ching in C. Chr. Ind. Fil. Suppl. 3: 50. 1934; Ic. Fil. Sin. 3: pl. 120. 1935; Tagawa, Act. Phytotax. Geobot. 10: 292. 1941; Col. Ill. Jap. Pter. 89, 188, pl. 31, fig. 179. 1959; K. Iwatsuki, Act. Phytotax. Geobot. 18: 54. 1959; DeVol & Kuo, Fl. Taiwan 1: 350. 1975; Shieh, J. Sci. Eng. 13: 27. 1976; Hennipman, A monograph of the fern genus *Bolbitis* 280, fig. 81: a-c, 82. 1977.

*Campium subcordatum* Copel. Philip. Journ. Sci. 37: 369, fig. 23, pl. 16. 1928. Type from Hainan, *McClure 9436* (P, 2 sheets).

*Bolbitis formosana* Tagawa, Act. Phytotax. Geobot. 6: 92. 1937. Type from Taiwan, *Tagawa 984*.

*Acrostichum virens* sensu Henry, List Pl. Formos. 116. 1896; Matsum. & Hay. Enum. Pl. Formos. 641. 1906.

*Gymnopteris repanda* sensu Yabe, Bot. Mag. Tokyo 16: (48). 1902; Matsum. & Hay. Enum. Pl. Formos. 586. 1906.

*Leptochilus virens* sensu T. Ito, Zoku, Taiwan Shokubutsu Zuzetsu 31. 1928; Ogata, Ic. Fil. Jap. 2: pl. 78. 1929; Masamune, Short Fl. Form. 19. 1936.

*Bolbitis quoyana* sensu Tagawa, Act. Phytotax. Geobot. 6: 92. 1937.

*Representative Specimens Examined*

Ilan: Wu-shih-pi, *Masamune s. n.* Apr. 26, 1938 (TAI); Kuei-shan, *Kuo 333* (TAI); Kuei-shan Island, *Kuo 1564a* (TAI). Taipei: Wu-lai, *Kuo 971* (TAI); *Suzuki 17867* (TAI); *Ito s. n.* Apr. 3, 1915 (TAIF); Wan-tan, *Shimizu 3247* (TAI); Luh-shih-tang, *Kuo 1082* (TAI); Keelung, *Kuo & Kao 4285* (TAI); *Oldham 70* (K); *Wilford 478* (K); Nan-kang, *Kuo 449* (TAI); Ying-ho-tung, *Sheu 66* (TAI); *Chiang 23154* (TAI); Suang-feng, *Wei 185* (TAI); Huang-ti-tien, *Chen* (TAI); Wu-liao-chien, *Chiang 23691* (TAI); Ta-tau-shan, *Chiang & Liu 22840* (TAI); Shih-ting, *Chiang 1203* (TAI); Kuo-lai, *Chiang 955* (TAI); Tan-suei, *Hancock 15* (K); Chue-tzu, *Faurie 637* (B). Hsinchu: Shih-tou-shan, *Kuo 840* (TAI); *Fuji s. n.* Dec. 13, 1916 (TAIF). Taichung: Tung-shih, *Simozawa s. n.* March 1929 (TAI). Nantou: Lien-hua-chih, *Hibino & Suzuki s. n.* July 17, 1936 (TAI); *Kao 4041* (TAI). Pingtung: Syi-tzu-kou-syi, *Kuo & Yu 14877* (TAI); Nan-jen-shan, *Kuo & Yu 14188* (TAI); Pah-lu-syi, *Kuo & Yu 14356* (TAI); Lao-fo-shan, *Kudo & Mori s. n.* Apr. 8, 1930 (TAI). Taitung: Lan-yu, *Hanara s. n.* May 13, 1943 (TAI).

**2. *Elaphoglossum* J. Sm.**

Tagawa (1951) first enumerated the *Elaphoglossum* species then known from Taiwan; seven species (including one new species) were reported, viz. *E. angulatum*, *E. yoshinagae*, *E. lepidopodium*, *E. conforme*, *E. pendulifolium*, *E. callifolium*, and *E. subellipticum*. Kuo (1985) 36-37, 65-66 listed only six taxa, namely *E. angulatum*, *E. callifolium*, *E. commutatum*, *E. luzonicum*, *E. marginatum*, and *E. yoshinagae*. He sunk *E. pendulifolium* in *E. marginatum* (*E. conforme* sensu auct. Taiwan), and treated *E. subellipticum* as a synonym of *E. commutatum*. The name *E. lepidopodium* was substituted by *E. luzonicum*, following the literature. Here follows the treatment of Kuo (1985) on the *Elaphoglossum* species of Taiwan.

All *Elaphoglossum* species are rare in Taiwan. They generally grow in mossy and foggy forests as low epiphytes on tree trunks or rocks. They usually occupy elevations between 1500-2500 m but may sometimes be found at the summit or on ridges of mountains at low elevations, down to about 500 m.

## Key\* to the Species

\*The key is adopted after Kuo (1985) 65–66, which was modified from Tagawa (1951).

1. Rhizome long-creeping; stipes distant . . . . . 1. *E. angulatum*
  1. Rhizome short-creeping; stipes tufted or approximate . . . . . 2
  2. Lamina decurrent to near the base of the stipe . . . . . 6. *E. yoshinagae*
  2. Lamina-base cuneate, short-decurrent . . . . . 3
  3. Apex of lamina rounded . . . . . 4. *E. luzonicum*
  3. Apex of lamina acute to acuminate . . . . . 4
  4. Rhizome scales 5 mm long . . . . . 5. *E. marginatum*
  4. Rhizome scales 10 mm long . . . . . 5
  5. Scales straight and rather stiff, with inrolled margins . . . . . 2. *E. callifolium*
  5. Scales thin, crisped throughout, with long, twisted hairpoints . . . . . 3. *E. commutatum*
1. ***Elaphoglossum angulatum*** (Bl.) Moore, Ind. 5. 1857; Tagawa, Mem. Coll. Sci. Univ. Kyoto, B. 20: 28. 1951; Shieh, J. Sci. Eng. 13: 29. 1976; Holttum, Fl. Malesiana II, 1: 297. 1978.  
*Acrostichum angulatum* Bl. Enum. Pl. Java 101. 1828. Type from Java.  
*Elaphoglossum ogatae* C. Chr. Dansk Bot. Ark. 9(3): 67. 1937; Ogata, Ic. Fil. Jap. 8: pl. 381. 1940. Type from Taiwan, *Ogata 59*.  
*Elaphoglossum laurifolium* sensu Hayata, Ic. Pl. Form. 5: 293, fig. 117. 1915; Masamune, Short Fl. Form. 17. 1936.  
*Elaphoglossum latifolium* sensu T. Ito, Zoku Taiwan Shyokubutsu Zusetsu 377, 378. 1928.

## Representative Specimens Examined

Taichung: An-ma-shan, *Kuo 7793* (TAI); Siao-hsue-shan, *Wei 28* (TAI); Pa-sien-shan, *Huang 1365* (TAI). Nantou: Kuan-kao, *Sheu 632* (TAI); *Liu 750* (TAI). Chiayi: A-li-shan, *Suzuki 17965* (TAI); *Jeng 84* (TAI); *Kuo 165* (TAI); *Kuoh 8042* (TAI); *Wang 1818* (TAI); *Sasaki s. n.* Feb. 2, 1918 (TAIF); *Hayata & Ito s. n.* Feb. 6, 1914 (TAIF); *Kanehira & Sasaki s. n.* Feb. 1918 (TAIF). Kaoshiung: Shih-shan, *Hsu, Kuoh & Chang s. n.* Jan. 23, 1972 (TAI); *Kuo 2464* (TAI); *662* (TAI). Pingtung: Pei-ta-wu-shan, *Jeng 2737* (TAI); *Tateishi et al.* 19463 (TAI); *Kuo 10664* (TAI); *Matuda*

*s. n.* Nov. 20, 1918 (TAIF).

2. ***Elaphoglossum callifolium*** (Bl.) Moore, Ind. 7. 1857; Tagawa, Mem. Coll. Sci. Univ. Kyoto B, 20: 30. 1951; Shieh, J. Sci. Eng. 13: 30. 1976; Holttum, Fl. Malesiana II, 1: 307. 1978.  
*Acrostichum callifolium* Blume, Enum. Pl. Java 100. 1828. Type from Java, collected by Blume (B, 2 sheets).  
*Acrostichum latifolium* sensu Henry, A list of plants from Formosa 116. 1896.  
*Elaphoglossum latifolium* sensu Matsum. & Hay. Enum. Pl. Form. 640. 1906; Hayata, Gen. Ind. Fl. Form. 109. 1917; Masamune, Short Fl. Form. 17. 1936.

## Representative Specimens Examined

Kaoshiung: Shan-ping, *Tagawa 1790* (K). Pingtung: O-luan-pi, *Henry 1360* (K); Lao-fo-shan, *Kuo 14719* (TAI); *Kudo & Mori s. n.* Apr. 8, 1930 (TAI). Taitung: Hsin-kang-shan, *Yamamoto 1428* (TAI). Hualien: Ching-suei-shan, *Shimizu & Kao 11976* (TAI); An-tung-yue-shan, *Kao 6149* (TAI).

A specimen labeled "1360 ex parte, Dr. Henry June, 1894, *Acrostichum latifolium*, South Cape, Formosa", was found in the Kew Herbarium. Though Henry (1896) 116 first used the name *Acrostichum latifolium* for a Taiwan fern, based on Henry 1360 pro parte, as written in his list, the specimen is identical with other specimens called *Elaphoglossum callifolium* from Taiwan.

3. ***Elaphoglossum commutatum*** (Mett. ex Kuhn) v. A. v. R. Malayan ferns and fern allies, Suppl. 427. 1917; Holttum, Fl. Malesiana II, 1: 308. 1978; Kuo, Taiwaniana 30: 66. 1985.  
*Acrostichum commutatum* Mett. ex Kuhn, Ann. Mus. Bot. Lugd. Bat. 4: 292. 1869. Type from Ceylon, *Thwaites 1310* (B).  
*Elaphoglossum subellipticum* Rosenstock, Hedwigia 56: 348. 1915; Hayata, Ic. Pl. Form. 8: 150. 1919; Masamune, Short Fl. Form. 18. 1936; Tagawa, Mem. Coll. Sci. Univ. Kyoto B, 20: 31. 1951; Shieh, J. Sci. Eng. 13: 30. 1976. Type from Taiwan, Feng-chi-hu, 1500 m alt., May 1914, collected by *U. Faurie 488* (B, P).

## Representative Specimens Examined

Chiayi: Feng-chi-hu, *Faurie 488* (B, P).

4. ***Elaphoglossum luzonicum*** Copel., Leaf. Philip. Bot. 1: 235. 1907; Iwatsuki & Price, South East Asian Studies 14(4): 353. 1977; Holttum, Fl. Malesiana II, 1: 304. 1978; Kuo, Taiwania 30: 37. 1985. Syntypes from the Philippines, *Elmer 8190* and *Merrill 3250*.

*Elaphoglossum lepidopodum* C. Chr. Dansk Bot. Ark. 9(3): 66. 1937; Ogata, Ic. Fil. Jap. 8: pl. 380. 1940; Tagawa, Mem. Coll. Sci. Univ. Kyoto B. 20: 29. 1951; Shieh, J. Sci. Eng. 13: 29. 1976. Type from Taiwan, *Ogata 60*.

*Representative Specimens Examined*

Taitung: Ching-suei-ying, *Shimizu 3753* (TAI); *Tagawa 2375* (K); *Kuo 10427* (TAI); *Liew s. n.* Oct. 26, 1974 (TAI); Ku-tzu-lun-shan, *Kuo 1252* (TAI); Ta-shu-lin-shan, *Yamamoto s. n.* May 2, 1927 (TAI); *Kuo 1310* (TAI); Chi-Peng, *Sasaki s. n.* Feb. 25, 1925 (TAIF).

5. ***Elaphoglossum marginatum*** (Wall. ex Fée) T. Moore, Ind. Fil. 8, 11. 1857; 361. 1862; Sledge, Bull. Brit. Mus. (Nat. Hist.) Bot. 4: 89. 1967; Kuo, Taiwania 30: 37. 1985.

*Acrostichum marginatum* Wall. ex Fée, Mém. Fam. Foug. 2: 31. 1845. Type from Nepal, *Wallich 17* (K, 3 sheets).

*Elaphoglossum conforme* sensu Hayata, Ic. Pl. Form. 4: 257. 1914; Masamune, Short Fl. Form. 17: 1936; Ogata, Ic. Fil. Jap. 8: pl. 379. 1940; Tagawa, Mem. Coll. Sci. Univ. Kyoto B. 20: 29. 1951; Shieh, J. Sci. Eng. 13: 30. 1976.

*Elaphoglossum pendulifolium* Tagawa, Mem. Coll. Sci. Univ. Kyoto B. 20: 30. 1951; Shieh, J. Sci. Eng. 13: 30. 1976. Type from Taiwan, *Tagawa 2041*.

*Representative Specimens Examined*

Taipei: Wu-lai, *Do 451* (TAI); *Suzuki 18950* (TAI); Chi-sing-shan, *Masamune s. n.* Dec. 26, 1929 (TAI). Ilan: Tai-ping-shan, *Suzuki 528* (TAI). Taoyuen: Pei-chia-tien-shan, *Kuo 2598* (TAI); *2637* (TAI); Ta-man-shan, *Suzuki 18213* (TAI). Hsin-chu: Yuen-yang-hu, *Hsu & Kuoh 14247* (TAI); *Kuo 1497* (TAI). Taichung: An-ma-shan, *Liu et al. s. n.* Oct. 10, 1957 (TAI); *Kuo 15128* (TAI); Pa-sien-shan, *Suzuki 2934* (TAI); *Simozawa 453* (TAI). Nantou: Tung-pu,

*Jeng 2435* (TAI); Shan-lin-syi, *Huang 45* (TAI); Sa-li-sien-syi, *Moore 1138* (TAI); *Chen 3642* (TAD); *Hu 930* (TAI); *Kuo 15638* (TAI); Chi-tou, *Liu 231* (TAI); *Liu s. n.* Feb. 18, 1960 (NTUF); *s. n.* Feb. 14, 1960 (NTUF); Kuan-kao, *Liu 764* (TAI); New Middle Cross-Island Highway, *Chen 3576* (TAI); *Chiang 24709* (TAI). Chiayi: A-li-shan, *Jeng 2329* (TAI); *2288* (TAI); *2248* (TAI); *83* (TAI); *Kuoh 80345* (TAI); *Sasaki s. n.* Dec. 5, 1933 (TAI); *Kao 5575* (TAI); *7575* (TAI); *DeVol 3362* (TAI); *Kanehira & Sasaki s. n.* Oct. 7, 1927 (TAI); *s. n.* Feb. 1918 (TAIF); *Suzuki 19368* (TAI); *Huang & Kao 1661* (TAI); *Tanaka 5404* (NTUF); Ta-ta-chia, *Simozawa 452* (TAD); Feng-chi-hu, *Faurie 489* (P). Kaohsiung: Tien-chih, *Jeng 552* (TAI); South Cross-Island Highway, *Kuo 2750* (TAI); Teng-chi, *Tagawa 2034* (K). Pingtung: Pei-ta-wu-shan, *Jeng 2736* (TAI). Taitung: Kuei-hu, *Kao 6048* (TAI). Hualien: Tai-lu-ko, *Liu et al. 141* (TAI).

6. ***Elaphoglossum yoshinagae*** (Yatabe) Makino, Phan. Pter. Jap. Ic. Ill. t. 51, 52. 1901; Ogata, Ic. Fil. Jap. 1: pl. 27. 1928; Yamamoto, Suppl. Ic. Pl. Form. 5: 4. 1932; Masamune, Short Fl. Form. 18. 1936; Tagawa, Mem. Coll. Sci. Univ. Kyoto, B. 20: 29. 1951; Shieh, J. Sci. Eng. 13: 29. 1976.

*Acrostichum yoshinagae* Yatabe, Bot. Mag. Tokyo 5: 109, pl. 23. 1891. Type from Japan, *Yoshinaga s. n.* Aug. 1887.

*Representative Specimens Examined*

Taipei: A-yu, *Suzuki 18998* (TAI). Ilan: Tai-ping-shan, *Suzuki 1097* (TAI); *s. n.* Aug. 11, 1928 (TAI); ?, *Kawakami & Mori s. n.* June 10, 1906 (TAIF). Taoyuen: Pei-chia-tien-shan, *Kuo 2586* (TAI). Hsin-chu: Chien-shih, *Yamamoto s. n.* Sept. 8, 1925 (TAI). Miaoli: Yang-mei, *Kuo 2373* (TAI). Chiayi: A-li-shan, ? *s. n.* Dec. 1927 (TAI); *Matuda 423* (TAI). Pingtung: Dou-na-lin-tao, *Hsu s. n.* Nov. 14. 1986 (TAI); Li-kang, *Matuda s. n.* July 11, 1919 (TAIF).

**3. *Lomariopsis* Fée**

A single species in Taiwan:

1. ***Lomariopsis spectabilis*** (Kunze) Mett. Fil. Hort. Bot. Lips. 22. 1856; Tagawa, Act. Phytotax. Geobot. 16: 175. 1956; Hatusima, Mem. Fac. Agr. Kagoshima Univ. 7: 300. 1970; Shieh, J. Sci. Eng. 13:



29. 1976.

*Lomariopsis spectabilis* Kunze, Bot. Zeit. 6: 144. 1848.  
Type from Java, *Zollinger 395*.

*Lomariopsis leptocarpa* sensu Nakai, Bot. Mag. Tokyo. 47: 171. 1933; Masamune, Short Fl. Form. 19. 1936; Tagawa, Act. Phytotax. Geobot. 6: 165. 1937.

*Stenochlaena sorbifolia* sensu Yabe, Bot. Mag. Tokyo 16: (50). 1902; Matsum. & Hay. Journ. Coll. Sci. Imp. Univ. Tokyo Jap. 22: 609. 1906; T. Ito, Zoku Taiwan Shokubutsu Zusetsu 197. 1928; Ogata (rev. H. Ito), Ic. Fil. Jap. 3: pl. 525. 1981.

*Stenochlaena sorbifolia* var. *rigida* Yabe, nom. nud.; Matsum. & Hay., Enum. Pl. Form.: 609. 1906.

#### Representative Specimens Examined

Taipei: Tan-suei, *Hancock 1* (K); Keelung, *Ford 32* (K); s. n. June 18, 1884 (K); A-yu, *Tagawa 202* (K). Ilan: Su-ao, *Masamune s. n.* Apr. 26, 1938 (TAI). Pingtung: Nan-jen-shan, *Hsu & Kuoh 13146* (TAI); *Ohashi & others 14467* (TAI); *Kuo 1978* (TAI); *1977* (TAI); *14674* (TAI); *14355* (TAI); Suan-Liu, *Kao 7280* (TAI); Wan-chin, *Faurie 196* (B); Lao-fo-shan, *Soma s. n.* Jan. 1910 (TAIF). Taitung: Lan-yu, *Jeng 1587* (TAI); *Chiang 22484* (TAI); *Fukuyama & Suzuki 1066\** (TAI); *Masamune 3850\** (TAI); *4152* (TAI); *Sasaki s. n.* June 5, 1926 (TAI); s. n. May 4, 1924\* (TAIF); s. n. June 15, 1911\* (TAIF); *Liu & others 112* (TAD); *Yamamoto s. n.* June 3, 1947 (TAD); *Kuoh 4870A* (TAI); *Huang & Kao 7557* (TAD); *Kawakami & Sasaki s. n.* July 1912 (TAIF).

Holttum (1978) noted that specimens named *L. spectabilis* from Taiwan and Hainan might be a distinct species. In Taiwan this is a rare species, as stated by Tagawa (1956), but it is usually locally abundant, growing in ravines at lower elevations. Most specimens collected in Taiwan bear only sterile fronds which may be simple and entire, trifoliolate, or generally once-pinnate. Only four specimens, asterisked above, bear fertile fronds; all were collected on Lan-yu in the summer, from May to July. Judging from its rarity, local

habitats and distribution, and the degree of frond fertility, it is suspected that the distribution center of the species is not in Taiwan but in the Philippines or elsewhere in tropical Asia. It is concluded that the identity of *L. spectabilis* in Taiwan needs further study; a revision of *L. spectabilis* and related species is required.

**Acknowledgements.** This work was supported by the grants of National Science Council, Republic of China (NSC 75-0201-B002-16).

#### Literature Cited

- Alston, A. H. G. 1956. The subdivision of the Polypodiaceae. *Taxon* 5: 23-25.
- DeVol, C. E. and C. M. Kuo. 1975. Lomariopsidaceae, *In*: Li and others (eds.), *Flora of Taiwan* 1: 347-358. Epoch, Taipei.
- Hennipman, E. 1977. A monograph of the fern genus *Bolbitis* (Lomariopsidaceae). Leiden University Press, The Hague. 331 pp.
- Henry, A. 1896. A list of plants from Formosa with some preliminary remarks on the geography, nature of the flora and economic botany of this island. *Trans. Asiat. Soc. Jap.* 24 (Suppl.): 1-118.
- Holttum, R. E. 1978. Lomariopsis group, *In*: van Steenis & Holttum (eds.), *Flora Malesiana* II, 1: 255-330.
- Iwatsuki, K. 1959. Taxonomic studies of Pteridophyta IV. *Act. Phytotax. Geobot.* 18: 44-59.
- Kuo, C. M. 1985. Taxonomy and phytogeography of Taiwanese pteridophytes. *Taiwania* 30: 5-100.
- Kuo, C. M. and B. J. Wang. 1985. Additional knowledge for the fern flora of Taiwan I. On the name *Bolbitis scalpturata* (Fée) Ching and its recollection after 76 years. *Yushania* 2 (2): 1-6.
- Kuo, C. M. and H. T. Yu. 1986. A study of pteridophytes in Kenting National Park. Headquarters of Kenting National Park. 114pp. (A mimeographed paper).
- Pichi-Sermolli, R. E. G. 1968. *Adumbratio Florae Aethiopicae* 15. Elaphoglossaceae. *Webbia* 23: 209-246.
- Tagawa, M. 1951. *Elaphoglossum* of Japan, Ryukyu, and Formosa. *Mem. Coll. Sci. Univ. Kyoto B.* 20: 26-31.
- Tagawa, M. 1956. Occasional notes on Asiatic pteridophytes 7. *Act. Phytotax. Geobot.* 16: 174-178.

# 台灣的藤蕨科植物

郭城孟

國立台灣大學植物學系

台灣產的藤蕨科植物經研究整理之後，共計有三屬十三種與二雜交種，合計十五個分類群，其中之一係首次發表之新雜交種。